Neutron "Ship Effect" - An Experimental Study -

What is the Neutron "Ship Effect"

- The "ship effect" is the increase in the neutron background generated by cosmic rays near large masses of metal, such as ships or bridges
- High-energy cosmic-ray neutrons hit iron nuclei and excite them, releasing many fission-energy neutrons
- Ship effect neutrons can cause nuisance alarms that interfere with detection and identification of hidden nuclear materials in such locations

Collaborators

- DHS/EML
- University of Delaware
- Remote Sensing Laboratory (RSL), Andrews AF Base
- U.S. Naval Academy
- Coast Guard (R&D Center)

Goals

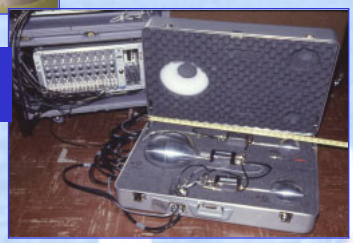
- Understand the cosmic ray induced background neutron spectrum and how large masses of metal change it
- Database of expected change in background count rates for specific neutron detectors on/in/near ships, buildings, bridges

Instruments Used

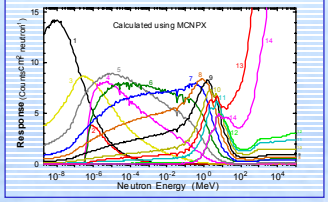
Multisphere Neutron Spectrometer (Bonner Spheres)

Set of spherical moderators of different sizes surrounding slow-neutron detectors

EML amplifier design

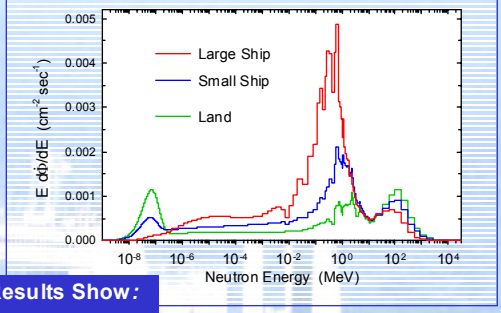


Response Functions of EML Extended-Energy Multisphere Neutron Spectrometer



Preliminary Data

Cosmic-Ray Neutron Spectra Measured on Ships and on Land

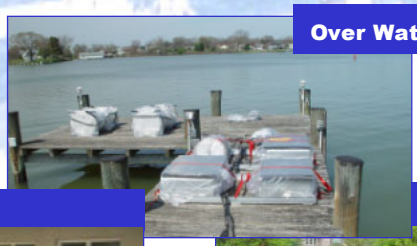


Early Results Show:

- small ship 2 times land
- large ship 4 times land

Ashore

Over Water



Naval Academy

Indoors

Ground Measurements, Houston

Outdoors

Small ship

USS Barry Display Ship in Washington Navy Yard

Midshipmen Set Up Spectrometer on USS Barry

Large Ship

Spectrometer Packed for Transport

USNS Mendonca

Length: 950 feet
Beam: 106 feet
Draft: 34 feet
Displacement: 62,069 long tons

Without cargo

EML Spectrometer on Mendonca C Deck

With cargo

EML Spectrometer on Mendonca A Deck